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EXAMINER	
FOTAKIS, ARISTOCRATIS	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/719,061	Applicant(s) KOGA ET AL.	
	Examiner ARISTOCRATIS FOTAKIS	Art Unit 2611	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07/14/2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 - 4, 6 - 16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 - 4, 6 - 16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *05/23/2008*.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Terminal Disclaimer

The terminal disclaimer filed on May 23, 2008 disclaiming the terminal portion of any patent granted on this application which would extend beyond the expiration date of US 7,164,724 has been reviewed and is accepted. The terminal disclaimer has been recorded.

Response to Arguments

Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection.

Claim Objections

Claim 7 is objected to because of the following informalities: Claim 7 recites of "first inverse wavelet transformer" in Lines 1 - 2 and "second inverse wavelet transformer" in Lines 3 - 4 of Page 7 and should be corrected to "first wavelet transformer" and "second wavelet transformer". Appropriate correction is required.

Claim 11 is objected to because of the following informalities: Claim 11 was amended to add the limitations in lines 9 – 12 of page 10. These limitations refer to the transmitter and could be moved to page 9 under the transmitter limitations of the claim. Appropriate correction is required.

Claim 15 is objected to because of the following informalities: Claim 15 recites of “first inverse wavelet transformer” in Lines 8 - 9 and “second inverse wavelet transformer” in Lines 10 - 11 of Page 13 and should be corrected to “first wavelet transformer” and “second wavelet transformer”. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 6 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kjeldsen et al (US PG-Pub 20030231714) in view of Xie et al ("*A combined DMT/DWMT system for DSL application*", University of Singapore, Indian Institute of Science, Signal Processing 80 (2000) 185 – 195, 2000 Elsevier Science B.V) and further in view of Butash (US 6,351,451).

Kjeldsen teaches of a multicarrier receiver for performing data reception by way of digital multicarrier demodulation using a real coefficient wavelet filter bank, said multicarrier receiver (Figs 1 and 7) comprises: a first multiplier and a second multiplier for downconverting a received bandpass signal to a baseband signal (Fig.1, WPM Receiver, Paragraph 0068); a local oscillator for providing said first multiplier with a signal of a predetermined frequency (shown in Fig.1, Paragraph 0068); a $\pi/2$ phase

shifter for delaying the phase of said local oscillator by *π/2* to generate a carrier orthogonal to said second multiplier (shown in Fig.1, Paragraph 0068); a first wavelet transformer for performing wavelet transform on an in-phase signal and an orthogonal signal output from each of said first LPF and said second LPF (#132, DWPT, Figs.1 and 7, Paragraph 0075); a parallel-to-serial converter for converting a parallel signal output from said equalizer to a serial signal (Multiplexer MUX, #136, Fig.1, Paragraph 0014 and 0077); and a determination unit for determining serial data output from said parallel-to-serial converter (Complex Symbol Detection, Paragraph 0077, Fig.1). However, Kjeldsen does not specifically teach of an equalizer for equalizing each parallel signal of an in-phase signal and a quadrature signal output from said first wavelet transformer as a complex signal of each subcarrier and the configuration of the first wavelet transformer. Kjeldsen does not specifically teach of a first LPF and a second LPF for removing an unwanted signal outside the band of a baseband signal output from each of said first and said second multipliers.

Xie teaches of a combined DMT/DWMT system for DSL application. The receiver comprises of a lowpass filter, a first wavelet transformer, an equalizer (post-detection and pre-detection equalizer, Fig.5), a parallel to serial converter and a determination unit (decoder and b(RT) bit buffer, Fig.5). Xie teaches of an equalizer for equalizing each parallel signal of an in-phase signal and an orthogonal signal output from said first wavelet transformer as a complex signal of each subcarrier (Fig.5, Page 190). Xie also teaches of the first wavelet transformer comprising: M-1 single sample delay elements for inputting an in-phase signal and an orthogonal signal output from

said LPF (Fig.4, Z^{-1}); M downsamplers for inputting output data of said single sample delay elements (Fig.4); a first prototype filter for inputting output data of said M downsamplers (Fig.4, $r_0 - r_{2M-1}$, equation 8, Page 189), ; and a high-speed discrete cosine transformer for inputting output data of said first prototype filter (IFFT and Page 189, equations 6 – 7).

Butash teaches of a receiver where the received signal is outputted from the A/D converter coupled as an input to two multipliers (15, 17, Fig.6). The outputs of the multipliers are coupled as inputs to identical low pass filters (LPF, 18 and 20). The real and quadrature outputs of the filters are coupled as inputs to a filter tree (22), whose outputs in turn are coupled to a PPF-FFT (24) (Fig.6 and Col 3, Lines 65 – 67 to Col 4, Lines 1 - 27).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have equalized the complex signal from the wavelet transformer to enable a high rate operation for the wireless channels. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the wavelet transformer configuration of Xie to introduce immunity to narrowband interference without adding complexity to the system. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used two separate low-pass filters used to prevent higher frequencies and to remove any distortion generated by the A/D converter separately in the I and Q signals.

Claims 1 – 4, 7 - 11 and 14 - 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Sandberg et al. (US 5,715,280) in view of Xie et al in view of Mandyam (US 6,940,828).

Re claim 11, Sandberg and Xie together teach of a multicarrier communications apparatus comprising a multicarrier transmitter and a multicarrier receiver, said multicarrier communications apparatus performing data transmission by way of digital multicarrier modulation/demodulation using a real coefficient wavelet filter bank including M real coefficient wavelet filters (M being a positive integer), said multicarrier communications transmitter comprising: a signal point mapping unit for converting bit data to symbol data to map said symbol data on M/2 complex coordinate planes; a serial-to-parallel converter for converting serial data as said mapped symbol data to parallel data; a first inverse wavelet transformer comprising said M real coefficient wavelet filters orthogonal to each other, said first inverse wavelet transformer outputting an in-phase signal of said complex data; a second inverse wavelet transformer comprising said M real coefficient wavelet filters orthogonal to each other, said second inverse wavelet transformer outputting an orthogonal signal of said complex data; and an SSB modulator for performing SSB modulation (Col 6, Lines 55 – 57) by using the output from said first inverse wavelet transformer as an in-phase signal of complex information and the output from said second inverse wavelet transformer as an orthogonal signal of complex information; and wherein a detector of said multicarrier receiver comprises: a multiplier for downconverting a received bandpass signal as a

receive signal of a received bandpass signal to a baseband signal; a local oscillator for providing said multiplier with a signal of a predetermined frequency; a LPF for removing an unwanted signal outside the band of a baseband signal output from said multiplier; a first wavelet transformer comprising M real coefficient wavelet filters orthogonal to each other, said first wavelet transformer inputting the output data from said LPF (as discussed above in claims 14 – 16).

However, Sandberg does not specifically teach of a complex data decomposer for inputting said parallel data as well as decomposing complex data into a real part and an imaginary part so as to supply an in-phase component of complex information to the (2n-1)th input to said first and said second inverse wavelet transformers and supply an orthogonal component to the 2nth input (where 1<n<(M/2-1)), a subcarrier number is 0 to M-1) and a complex data generator for generating complex data by using the (2n-1)th output from said first wavelet transformer as an in-phase component of complex information and 2nth output as an orthogonal component (where 1 <n<(M/2-1)), a subcarrier number is 0 to M-1), wherein the first and second inverse wavelet transformers include a discrete cosine transformer and a discrete sine transformer respectively.

Xie teaches of a complex data decomposer for inputting said parallel data as well as decomposing complex data into a real part and an imaginary part so as to supply an in-phase component of complex information to the (2n-1)th (n is k, Page 188, Col 2) input to inverse wavelet transformer and supply an orthogonal component to the 2nth input (where 1<n<(M/2-1)) (Page 188, Col 2), a subcarrier number is 0 to M-1) and a

complex data generator for generating complex data by using the (2n-1)th output from said first wavelet transformer as an in-phase component of complex information and 2nth output as an orthogonal component (where 1 <n<(M/2-1)), a subcarrier number is 0 to M-1) (Figs 3 – 5, Pages 188 – 189). However, Xie does not disclose of a first and second transformers including a discrete cosine transformer and a discrete sine transformer.

Mandyam teaches of an OFDM transmitter that discloses of two separate transformers, a discrete cosine transformer and a discrete sine transformer (#46-1 and #46-2, Fig.3). The use of either a DST or DCT transform can be selected for an OFDM system (Col 8, Lines 55 - 61).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the inverse wavelet and wavelet transformer configuration of Xie including the data decomposing and composing to introduce immunity to narrowband interference without adding complexity to the system. It would have been a matter of designs choice to use either a DCT or DST, since Applicant has not disclosed that the use of a DST solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with the use of a DST instead of a DCT.

Re claim 14, Sandberg teaches of a multicarrier transmitter for performing data transmission by way of digital multicarrier modulation using a real coefficient filter bank, said multicarrier transmitter (Fig. 3) comprising:; a serial-to-parallel converter for

converting serial data as said symbol mapped series of information to parallel data (#301, Fig.3); a first wavelet transformer for performing a first transform on said parallel data (#302, Fig.3 and Col 1, Lines 25 – 30 and 47 - 62); a second wavelet transformer for performing a second transform on said parallel data (#312, Fig.3); and a modulator for performing modulation by using the output from said first wavelet transformer as an in-phase signal of complex information and the output from said transformer as an orthogonal signal of complex information (SSB modulation, Fig.3) (Col 6, Lines 34 – 67 to Col 7, lines 1 – 35, Fig.3). However, Sandberg does not specifically teach of a signal point mapping unit for performing symbol mapping of a series of information and the first and second transformers include a discrete cosine transformer and a discrete sine transformer respectively performing an inverse wavelet transformation including a plurality of real coefficient wavelet filters.

Xie teaches of a combined DMT/DWMT system for DSL application. The transmitter comprises of a serial to parallel converter (buffer and encoder, Fig.5), a wavelet transformer and a lowpass filter. Xie teaches of a signal point mapping unit for performing symbol mapping of a series of information (QAM, Page 188, Paragraph 1, Col 2) and the first and second inverse wavelet transformer both including a plurality of real coefficient wavelet filters (equation 4). However, Xie does not disclose of a first and second transformers including a discrete cosine transformer and a discrete sine transformer.

Mandyam teaches of an OFDM transmitter that discloses of two separate transformers, a discrete cosine transformer and a discrete sine transformer (#46-1 and

#46-2, Fig.3). The use of either a DST or DCT transform can be selected for an OFDM system (Col 8, Lines 55 - 61).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a symbol mapper to include the I and Q components to be processed in the receiver and to clearly show that the cosine modulation of Sandberg (Col 6, Lines 50 – 67) that both the first and second inverse wavelet transformers would include a plurality of real coefficient wavelet filters to improve the orthogonality of the signal. It would have been a matter of designs choice to use either a DCT or DST, since Applicant has not disclosed that the use of a DST solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with the use of a DST instead of a DCT.

Re claim 15, Sandberg teaches of a multicarrier receiver for performing data reception by way of digital multicarrier demodulation using a real coefficient wavelet filter bank, said multicarrier receiver (Figs.2 and 3) comprising: a multiplier for downconverting a received bandpass signal to a baseband signal (Abstract, Fig.2); a local oscillator for providing said multiplier with a signal of a predetermined frequency (demodulation, Col 5, Lines 8 – 18); a LPF for removing an unwanted signal outside the band of baseband signal output from said multiplier (#202, 212, Fig.2); a wavelet transformer for performing a wavelet transform on an output signal from each said LPF (#221, Fig.2 and #342, Fig.3 and Col 1, Lines 25 – 30 and 47 - 62); an equalizer for equalizing each parallel signal of an in-phase signal output and an orthogonal signal

output from said transformer as a complex signal of each subcarrier (#124, Fig.1); a parallel-to-serial converter for converting an equalized parallel signal output from said equalizer to serial data (#126, *the parallel signal from the equalized FFT would have to be serialized for the decoder to decode the signal*); determination unit for determining serial data output from said parallel-to-serial converter (#128, Fig.1, Col 4, Lines 25 – 67). However, Sandberg does not specifically teach of a first and second wavelet transformer (instead of one transformer) including a discrete cosine transformer and a discrete sine transformer respectively performing a wavelet transformation including a plurality of real coefficient wavelet filters.

Xie teaches of a combined DMT/DWMT system for DSL application. The receiver comprises of a lowpass filter, a first wavelet transformer, an equalizer (post-detection and pre-detection equalizer, Fig.5), a parallel to serial converter and a determination unit (decoder and b(RT) bit buffer, Fig.5). Xie teaches of the wavelet transformer including a plurality of real coefficient wavelet filters (equation 4). However, Xie does not disclose of a first and second transformers including a discrete cosine transformer and a discrete sine transformer.

Mandyam teaches of an OFDM receiver that discloses of two separate transformers, a discrete cosine transformer and a discrete sine transformer (#82-1 and #82-2, Fig.3). The use of either a DST or DCT transform can be selected for an OFDM system (Col 8, Lines 55 - 61).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used to have used discrete wavelet transform of Xie on Sandberg's first and second inverse wavelet transformer that would include a plurality of real coefficient wavelet filters to improve the orthogonality of the signal. It would have been a matter of designs choice to have a receiver that performs the reverse operation of the transmitter to clearly show the two separate transformers for simplicity reasons and use either a DCT or DST, since Applicant has not disclosed that the use of a DST solves any stated problem or is for any particular purpose and it appears that the invention would perform equally well with the use of a DST instead of a DCT.

Re claim 16, Sandberg and Xie together teach of a multicarrier communications apparatus comprising the multicarrier transmitter (according to claim 14) and a multicarrier receiver for performing data reception by way of digital multicarrier demodulation using a real coefficient wavelet filter bank, said multicarrier receiver comprising: a multiplier for downconverting a received bandpass signal to a baseband signal; a local oscillator for providing said multiplier with a signal of a predetermined frequency; an LPF for removing an unwanted signal outside the band of baseband signal output from said multiplier; a first wavelet transformer for performing a first wavelet transform on an output signal from said LPF, said first wavelet transformer including a plurality of real coefficient wavelet filters; a second wavelet transformer for performing a second wavelet transform on the output signal from said LPF, said second wavelet transformer including a plurality of real coefficient wavelet filters; an equalizer

for equalizing each parallel signal of an in-phase signal output from said first wavelet transformer and an orthogonal signal output from said second wavelet transformer as a complex signal of each subcarrier; a parallel-to-serial converter for converting an equalized parallel signal output from said equalizer to serial data; and a determination unit for determining serial data output from said parallel-to-serial converter, wherein: said multicarrier communications apparatus performs data transmission by way of digital multicarrier modulation/demodulation using a real coefficient wavelet filter bank (see rejections of claims 14 and 15).

Re claim 1, Sandberg, Xie and Mandyam teach of a multicarrier transmitter for performing data transmission by way of digital multicarrier modulation using a real coefficient wavelet filter bank, said multicarrier transmitter comprises: a signal point mapping unit for performing symbol mapping of a series of information; a serial-to-parallel converter for converting serial data as said symbol mapped series of information to parallel data; a first inverse wavelet transformer including a plurality of real coefficient wavelet filters orthogonal to each other, said first inverse wavelet transformer performing a first inverse wavelet transform on said parallel data; a second inverse wavelet transformer including: real coefficient wavelet filters of said first inverse wavelet transformer where Hilbert transform (Sandberg, *Hilbert transform*, Col 6, Lines 61 – 64) has been made, said second inverse wavelet transformer performing a second inverse wavelet transform on said parallel data; and a modulator for performing SSB modulation (SSB, Col 6, Lines 55 – 58, reference or Sandberg) by using the output from said first

inverse wavelet transformer as an in-phase signal of complex information and the output from the second inverse wavelet transformer as an orthogonal signal of complex information (Please see rejection of claim 14).

Re claims 2 – 4, Sandberg, Xie and Mandyam teach all the limitations of claim 1 as well as Sandberg teaching the inverse wavelet transformers in the transmitter (Fig.3). However, Sandberg does not teach of the configuration of an inverse wavelet transformer.

Xie teaches of a combined DMT/DWMT system for DSL application. The transmitter comprises of a serial to parallel converter (buffer and encoder, Fig.5), a wavelet transformer and a lowpass filter. The inverse wavelet transformer comprises of a high-speed discrete cosine transformer (FFT, Fig.3) for inputting parallel data from the serial-to-parallel converter (parallel data as shown in Fig.3); a first prototype filter including a polyphase filter having a real coefficient ($p_0(n)$, Page 188, Col 2), said first prototype filter inputting output data of said high-speed discrete cosine transformer (Fig.3); M upsamplers for inputting output data of said first prototype filter (Fig.3); and M-1 single sample delay elements for inputting output data of said upsamplers (Fig.3, Z^{-1}).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the inverse wavelet transformer configuration of Xie to introduce immunity to narrowband interference without adding complexity to the system.

Re claim 7, Sandberg, Xie and Mandyam teach of a multicarrier receiver for performing data reception by way of digital multicarrier demodulation using a real coefficient wavelet filter bank, said multicarrier receiver comprises: a multiplier for downconverting a received bandpass signal to a baseband signal; a local oscillator for providing said multiplier with a signal of a predetermined frequency; an LPF for removing an unwanted signal outside the band of baseband signal output from said multiplier; a first wavelet transformer for performing a first wavelet transform on an output signal from said LPF; a second wavelet transformer for performing Hilbert transform on the real coefficient wavelet filters of said first wavelet transformer (Sandberg, *Hilbert transform*, Col 6, Lines 36 – 64), said second wavelet transformer including said real coefficient wavelet filters of the first wavelet transformer where Hilbert transform has been made, said second wavelet transformer performing a second wavelet transform on an output signal from said LPF; an equalizer for equalizing each parallel signal of an in-phase signal output from said first wavelet transformer and an orthogonal signal output from said second wavelet transformer as a complex signal of each subcarrier; a parallel-to-serial converter for converting an equalized parallel signal output from said equalizer to serial data; and a determination unit for determining serial data output from said parallel-to-serial converter. (Please see rejection of claim 15).

Re claims 8 – 10, Sandberg, Xie and Mandyam teach all the limitations of claim 7 as well as Sandberg teaching the inverse wavelet transformers in the transmitter (Fig.3)

and the wavelet transformation in the receiver side. However, Sandberg does not teach of the configuration of a wavelet transformer.

Xie teaches of a combined DMT/DWMT system for DSL application. The receiver comprises of a lowpass filter, a first wavelet transformer, an equalizer (post-detection and pre-detection equalizer, Fig.5), a parallel to serial converter and a determination unit (decoder and b(RT) bit buffer, Fig.5). Xie teaches of an equalizer for equalizing each parallel signal of an in-phase signal and an orthogonal signal output from said first wavelet transformer as a complex signal of each subcarrier (Fig.5, Page 190). Xie also teaches of the first wavelet transformer comprising: M-1 single sample delay elements for inputting an in-phase signal and an orthogonal signal output from said LPF (Fig.4, Z^{-1}); M downsamplers for inputting output data of said single sample delay elements (Fig.4); a first prototype filter for inputting output data of said M downsamplers (Fig.4, r_0 – r_{2M-1}, equation 8, Page 189), ; and a high-speed discrete cosine transformer for inputting output data of said first prototype filter (IFFT and Page 189, equations 6 – 7).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have equalized the complex signal from the wavelet transformer to enable a high rate operation for the wireless channels. It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used the wavelet transformer configuration of Xie to introduce immunity to narrowband interference without adding complexity to the system.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sandberg and Xie in view of Smart et al (US 2002/0041637).

Sandberg and Xie teach all the limitations of claim 11, as well as Sandberg further teaching of the multicarrier communications transmitter comprising of a synchronization data generator for generating a signal as data known to said multicarrier receiver and the multicarrier transmitter as a modulator for inputting said signal as known data from said synchronization data generator (symbol generator, transmitter Clock #107 and receiver clock #133, Col 4, Lines 10 – 20). However, Sandberg and Xie do not specifically teach of the multicarrier receiver comprising: the detector for outputting adjacent complex subcarrier data including a subcarrier pair and a synchronization estimation circuit for estimating symbol synchronization timing from the difference between said adjacent complex subcarrier data items.

Smart teaches of a multicarrier receiver (Fig.15) comprising: the detector for outputting adjacent complex subcarrier data including a subcarrier pair (Paragraph 0028) and a synchronization estimation circuit for estimating a symbol synchronization timing from the difference between said adjacent complex subcarrier data items (*sliding window receiver*, Paragraphs 0196 – 0197 and 0223).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a sliding window system to provide good orthogonality between adjacent subcarriers for improving the bandwidth efficiency of the communication system.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Aristocratis Fotakis whose telephone number is (571) 270-1206. The examiner can normally be reached on Monday - Thursday 6:30 - 4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Aristocratis Fotakis/

Examiner, Art Unit 2611

/Chieh M Fan/

Supervisory Patent Examiner, Art Unit 2611